PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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30. März 2005

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	29.03.2005
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
P 64659	

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP 03/12349	05.11.2003	19.12.2002

Applicant
SPECIALTY MINERALS MICHIGAN INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority:

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
P 64659		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP 03/12349	05.11.2003	19.12.2002
International Patent Classification (IPC) or both national classification and IPC		
G01J5/04		
Applicant		
SPECIALTY MINERALS MICHIGAN INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 12 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11.06.2004	29.03.2005
Name and mailing address of the international preliminary examining authority:	Authorized Officer
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 03/12349

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-6 as originally filed

Claims, Numbers

1-9 received on 23.12.2004 with letter of 21.12.2004

Drawings, Sheets

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:

   ☐ restricted the claims.

   ☒ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

   ☐ complied with.

   ☒ not complied with for the following reasons:

   see separate sheet

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

   ☒ all parts.

   ☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-9
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1,2, 6
	No:	Claims	3-5, 7-9
Industrial applicability (IA)	Yes:	Claims	1-9
	No:	Claims	

2. Citations and explanations

see separate sheet

CITED DOCUMENTS

Reference is made to the following documents:

D1: EP-A-1 134 295 (VOEST ALPINE IND INC) 19 September 2001 (2001-09-19)
D2: US-A-4 619 533 (PEACEY JOHN G ET AL) 28 October 1986 (1986-10-28)
D3: PATENT ABSTRACTS OF JAPAN vol. 010, no. 036 (C-328), 13 February 1986 (1986-02-13) & JP 60 187608 A (KAWASAKI SEITETSU KK), 25 September 1985 (1985-09-25)
D4: LU 90 610 A (SIDMAR NV ;WURTH PAUL SA (LU)) 11 January 2002 (2002-01-11)
D5: CARLHOFF C ET AL: 'LASERINDUZIERTE EMISSIONSSPEKTROSKOPIE FUER DIE DIREKTANALYSE VON FLUESSIGEM STAHL IM KONVERTER' LASER UND OPTOELEKTRONIK, FACHVERLAG GMBH. STUTTGART, DE, vol. 23, no. 4, 1 August 1991 (1991-08-01), pages 50-52, XP000216633 ISSN: 0722-9003
D6: US-A-4 416 443 (HELFI ALFRED F ET AL) 22 November 1983 (1983-11-22)
D7: PATENT ABSTRACTS OF JAPAN vol. 2000, no. 02, 29 February 2000 (2000-02-29) & JP 11 326061 A (SUMITOMO METAL IND LTD), 26 November 1999 (1999-11-26)
D8: US-A-5 283 608 (GOO BONJEONG ET AL) 1 February 1994 (1994-02-01)

a.) Document D1 discloses an apparatus for viewing the interior of a molten metal bath through a tuyere comprising sensor combinations aligned along one optical path corresponding to the optical axis of assembly. An oxygen-containing gas is at times passed through the tuyere the keep the passage open.

b.) Document D2 describes an apparatus for measuring the bath temperature of metallurgical furnaces with a two-wavelength pyrometer. Means are provided for air purging the viewing periscope.

c.) Document D3 refers to an apparatus for monitoring the condition in front of a blast furnace tuyere by means of an optical sensor and a television camera.

d.) Document D4 discloses a device for monitoring the blocking in the tuyere zone of a blast furnace with an optical sensor, e.g. a dual-wavelength pyrometer.

e.) Document D5 relates to laser-induced emission spectral analysis and document D6 to the detection of tuyere blockage through temperature measurements

f.) Document D7 describes the use of a CCD camera for measuring the temperature of a molten bath, wherein images from the tip section of a tuyere are obtained.

g.) Document D8 discloses an autofocusing camera used to determine the distance between an object and the camera.

Re Item IV

Lack of unity of invention

The International Searching Authority found multiple inventions in this international application, as follows:

1. Claims: 1-2, 7-9

   Process and apparatus for keeping a tuyere passing through a metallurgical vessel free of skull by intermittently passing an oxygen-containing gas through the tuyere, wherein the moment for starting to pass said gas is determined on the basis of threshold data derived by a dual wavelength pyrometer from a spot in the interior of the melt.

2. Claims: 3-5

   Use of a video camera for adjusting the optical axis of an instrument sensing radiation through a tuyere.

3. Claim : 6

   Method for measuring the length of a tuyere passing through a metallurgical vessel by means of an autofocus video camera.

Claim 3 and claim 6 have the following feature in common:

a step of obtaining an image of the first end of the tuyere facing the interior of the metallurgical vessel with a video camera.

Since this feature is, however, generally known (see, for instance, D7 - abstract; fig. 1), it does not constitute a special technical feature in the sense of Rule 13.2 PCT.

Starting from this step, claim 3 relates to the problem of aligning optical components within a sensing device. The solution comprises the use of a video camera for obtaining video images from both ends of the tuyere. Claim 6 addresses the problem of determining the length of a tuyere, the solution comprising an autofocus video camera focussing on the first end of the tuyere.

In view of these different problems addressed and the distinct solutions proposed, the technical interrelationship between the subject-matter of claims 3 and 6 does not involve any other of the same and/or corresponding technical features than the step mentioned above.

Since claim 1 does not have any technical features in common with claims 3 and 6, the technical interrelationship between claims 1 and 3, on one hand, and claims 1 and 6, on the other hand, does not involve any special technical features either.

Therefore, the requirement of unity of invention of Rule 13.1 is not met.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Claims 1, 2 and 7-9

1.1. The technical field concerned is keeping a tuyere passing through a metallurgical vessel free of skull.

1.2. Claims 1, 2 and 7-9 are based on originally filed claims 1, 2 and 7-9.

1.3. The process for keeping a tuyere passing through a metallurgical vessel free of skull according to claim 1 differs from the prior art disclosed in documents D1-D4 in that an oxygen-containing gas is passed through the tuyere only in response to the two intensity measurements from the dual wavelength falling below a certain threshold while at the same time the ratio of the measured intensities remains constant. Such a causal connection between specific thresholds obtained from dual wavelengths measurements and the passing of oxygen containing gas is neither known from nor hinted at by the cited prior art. The process of claim 1 is therefore considered to be new (Article 33(2) PCT) and to involve an inventive step (Article 33(3) PCT).

1.4. Claim 2 is dependent on claim 1 and as such also meets the criteria of the PCT with respect to novelty and inventive step.

1.5. Claim 7 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The expression "for carrying out the processes of claims 1 to 6" relates to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim.

1.6. Insofar as claim 7 pertains to the process of claim 1, the apparatus is assumed to require a *dual wavelength pyrometer* and *means for passing an oxygen-containing gas* for carrying out the process, as the actual measurement might be performed by a human operator. However, a *dual wavelength pyrometer* and *means for passing an oxygen-containing gas* are already disclosed in document D2 (abstr., fig. 1). The additional features of claim 7 (autofocus video camera and alignment means) are firstly unrelated to the problem to be solved, i.e. carrying out the process of claim 1, and secondly constitute only a slight constructional change which comes within the scope of the customary practice followed by persons skilled in the art, seeking for instance to visualize the blocked tuyere. Thus, claim 7 cannot be considered as involving an inventive step (Article 33(3) PCT).

1.7. Dependent claims 8 and 9 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in

respect of inventive step, the reasons being as follows:

cl. 8: The method of laser-induced emission spectral analysis based on a laser device and a spectrometer is a generally known method for the determination of element concentrations in molten metals - see document D5 (page 51, § 2; fig. 2).

cl. 9: The tuyere of document D1 (fig. 1) comprises an inner tube (6) connecting the apparatus (12) with the vessel.

2. Claims 3-5

2.1. The technical field concerned is alignment of measurement instruments with a tuyere.

2.2. Claims 3 is based on originally filed claim 3, the description (page 4, § 3) and figure 4. Claims 4 and 5 are based on originally filed claims 4 and 5.

2.3. The use of a video camera of claim 3 lacks an inventive step (Article 33(3) PCT):

The document D3 (abstract; fig. 1) discloses:

- The use of a video detector (in television camera (6)) for checking the interior of a blast furnace, the video detector disposed within a measuring unit (2-7) including a video detector and an instrument (5) for measuring electromagnetic radiation emanating from the interior of a vessel through a tuyere (1) having a first end facing the interior of the metallurgical vessel and a second end facing the instrument, wherein said measuring unit (2-7) is arranged along an optical path (10).
- Alignment of the measuring unit (2-7) with respect to the tuyere (1) (such alignment is evident from fig. 1 of D3 - i.e. axis (10) is aligned with the axis of tuyere (2)).

The subject-matter of claim 3 differs from the disclosure of document D3 in that

I.) the claimed procedure is carried out in connection with metallurgical vessels,

ii.) the use of a video detector for adjusting the optical axis of a measuring unit is

disclosed, said adjustment being carried out on the basis of the video image by varying the orientation of the measuring unit such that the first end and second end in the video image form concentric circles.

ad I.) It is generally known to the person skilled in the art that the requirements and uses of optical measurement systems for blast furnaces (as in D3) and for metallurgical vessels are substantially equivalent - both systems comprising tuyeres preceding the optical devices. Thus, it would be obvious to the skilled person to use the video camera of D3 also for measurements within metallurgical vessels, where circumstances make it desirable.

In view of ii.) the problem to be solved by the present invention may be regarded as aligning the measuring unit with respect to the tuyere in a simple manner.

The user of the device of D3 would automatically use the video detector already provided in the system for aligning the measuring unit with respect to the tuyere, as it provides a visual image.
Moreover, the most obvious optical alignment is a concentric alignment, wherein the optical axis (10) of the measuring unit is concentrically aligned with the axis of the tuyere. Such a centralized alignment results in the maximal amount of radiation from the vessel impinging upon the video detector and the sensor. To this end, the skilled person would vary the orientation of the measuring unit until a concentrical alignment of the video images from the different ends of the tuyere is obtained and the measuring unit is thus concentrically aligned with the tuyere.

Thus, the skilled person seeking to align the measuring unit of D3 with the tuyere, would consider using the video detector in the way described in the paragraph above, thereby arriving at a use according to claim 3.

The subject-matter of claim 3 does therefore not involve an inventive step (Article 33(3) PCT).

2.4. Dependent claims 4 and 5 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in

respect of inventive step, the reasons being as follows:

cl. 4, 5: The use of specifically a pyrometer or a spectrometer as an instrument for measuring radiation would be generally known to the person skilled in the art.

3. Claim 6

3.1. The technical field concerned is measurement of the length of a tuyere.

3.2. Claim 6 is based on originally filed claim 6.

3.3. Document D7, which is considered to represent the most relevant state of the art, describes the use of a CCD camera for measuring the temperature of a molten bath, wherein images from the tip section of a tuyere are obtained.

The method of claim 6 differs from this known method in that the length of the tuyere is determined from the known distance between one end of the object and an autofocus camera and the measured distance between the other end of the object and the camera.

The subject-matter of claim 6 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as measuring the length of the tuyere.

No *autofocus* camera was indicated or hinted at in D7 (or any of the other prior art documents D1-D4 relating to tuyeres) and it's use in tuyere length measurements would not be immediately obvious to the person skilled in the art. Moreover, even if an autofocus camera were to be considered, as - for instance - disclosed in document D8, it specific deployment for tuyere length measurements as disclosed in claim 6 cannot be directly derived from the combination of documents D7 and D8.

Thus, the method of claim 6 involves an inventive step in the sense of Article 33(3) PCT.